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ABSTRACT

A study was conducted to assess the effect of token reinforcement for work behavior in a Headstart classroom and to investigate methods of withdrawing tokens while still maintaining the behavior. The class was treated as a whole and decisions to change from one condition to another were based on the group mean. The study was divided into two phases. In phase 1 a reversal design was employed. After a baseline period with no tokens, tokens were introduced, then removed, and then reintroduced. Results showed an increase in work behavior for the class as a whole during both token periods as compared with baseline and reversal periods. However, under these conditions several distinct individual response patterns to tokens occurred. In phase 2 check marks were substituted for tokens. Work behavior was maintained for all subjects. The study demonstrates that tokens can be effectively employed to increase work behavior in a preschool classroom and that individual children respond differently to institution and removal of tokens. Owing to the various individual response patterns that occurred under the token system, this study suggests new experimental strategies for applying token systems in classrooms. (The report contains 11 pages of graphs) (Author/RT)

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AN INVESTIGATION OF THE EFFECTS OF THE APPLICATION AND REMOVAL
OF A TOKEN ECONOMY ON THE WORKING BEHAVIOR OF SIXTEEN HEADSTART CHILDREN

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Basic research in the experimental analysis of behavior has gradually lead to socially relevant research, sometimes called applied behavior analysis. A great deal of work in applied behavior analysis has been conducted within the educational setting of the classroom investigating the effects of token economies on various behaviors (Birnbrauer, Wolf, Kidder and Tague, 1965; Bushell, Wrobel, and Michaelis, 1968; O'Leary, Becker, Evans, and Saudargas, 1969; Wolf, Giles, and Hall, 1963; Clark Lachowitz, and Wolf, 1968; Birnbrauer and Lawler, 1964). However, in much of this work the analysis of the effects of tokens was limited to either a small classroom of severely retarded children or to a few selected children from a large public school class. Only a few studies have dealt with an entire class of normal children when applying tokens and analyzing their effects (Bushell, Wrobel, and Michaelis, 1968; Birnbrauer, Wolf, Kidder and Tague, 1965).

Application of token contingencies is both easier to manage and more precise when attention is limited to a few subjects. A teacher is able to reinforce desired behaviors immediately and frequently. This precise programming can effect dramatic changes in the children's behavior. With larger groups of children reinforcement contingencies are less likely to be precisely timed and results may therefore not be as marked. In addition, within a large group, children are likely to differ both in the quality and schedule of reinforcement to which they will respond and in the types of behaviors that need to be developed. Despite this variability in children, when token contingencies have been applied to an entire classroom, the experimenters have typically attempted to modify the same response in each child and to apply the same reinforcement contingencies. In addition, although it is generally an accepted goal of applied reinforcement programs to eventually fade out the programmed reinforcers, there has been little study of this process.

To the best of our knowledge, only one study (O'Leary, Becker, Evans & Saudargas, 1969) has attempted to remove token reinforcers in a normal classroom setting.

The present study was designed to analyse the effects of a token economy on the working behavior of preschool children. The purpose of the study was fourfold: 1) to demonstrate empirically that token economies are an effective means of increasing the working behavior of a group of Headstart children; 2) to demonstrate that teachers relatively unsophisticated in behavior modification techniques can institute and maintain a token system; 3) to determine the range of individual responses to a token system; and 4) to explore means of fading out a token system while maintaining work behavior.

The Experimental Setting

The present study was conducted in a preschool classroom of nineteen four-year old children at a predominantly Black urban school in Pittsburgh, Pennsylvania. Two regular teachers, one head teacher and one ¹ assistant, taught in the classroom. In addition to the regular teacher, three student teachers from the University of Pittsburgh taught in the classroom throughout the study for approximately seven weeks each. None of the adults in the classroom were familiar with behavior modification techniques prior to the experiment. However, for approximately five weeks prior to the beginning of data collection, one of the experimenters gave the three teachers verbal instruction in reinforcement principles and their application.

The study was conducted five days a week for forty-five minutes a day. During the forty-five minute work period one of the teachers functioned as a "travelling teacher;"

2- We would like to thank Taube LaBovick, head teacher, for her cooperation in this study.

she directed the children to the materials, helped them begin work, and attended to them when they were working with the materials. After the work period, various play activities were available to the children--e.g., house area, flour table, show n' tell, outside play, etc.

The dependent variable for this study was attention to task or "work behavior". Two observers recorded data on four out of the five weekly school days. Data were collected for forty-five minutes on each day. One observer recorded the working behavior of the children using a time-sampling technique. Using a specially prepared form, observers moved through the list of children, at 10-second intervals, noting each child's "working" or "non-working" behavior. Working behavior was defined as follows: for each individual observation 1) a child was scored "W" for "working," if he had materials in hand and eyes on material; or 2) if a child was with a teacher, he was scored "W" if his eyes were on the teacher's or on his materials. If a child did not meet either of these criteria, he was scored as not working. Table 1 shows detailed definitions of work behavior. Approximately twenty observations per child were made each day. Due to a high rate of absence for four children, the data from only fifteen children were used in the final analysis. Interobserver reliability averaged 94%.

An independent observer recorded the three teachers' verbal comments to the children. Each teacher was observed daily for three five minute periods spread throughout the forty-five minutes. Using a special form, the observer recorded three categories of verbal behavior: 1) instructions (neutral comments), 2) positive comments, and 3) negative comments. Table 4 lists the comments scored as "positive." Interobserver reliability on this measure was 94%.

Effect of Tokens on Group Performance

The first part of the study, a within-group design, consisted of four stages:

1) No Tokens, or "baseline;" 2) Tokens Contingent Upon Working; 3) Tokens Not Contingent Upon Working; and 4) Tokens Contingent Upon Working. During the No Token period (or baseline) children worked with the academic materials for forty-five minutes. The teachers verbally attended to working behavior of the children, but did not give out any tokens. After forty-five minutes, the children went to any play activity they chose. (FIGURE 1) These data show the mean working behavior for fifteen children during baseline. As you can see, the mean for the last five days was 59%.

During the next stage, Tokens Contingent Upon Working Behavior, the teacher gave the children tokens contingent upon working with the academic materials. Children had to "buy" admission to activities during the play period. On each day approximately four different activities were available at four different prices. The prices were set so the children could normally play in only one activity per day. Occasionally, after snack, small pieces of candy were exchanged for leftover tokens. Occasionally, some children did not earn enough tokens to exchange for activities. These children would sit at tables during the play activities and wait until the activities terminated. (FIGURE 2) This figure shows the change in work behavior during this period. As you can see, the behavior began to increase. The mean for the last five days was 74%.

During the next stage, Tokens Not Contingent Upon Working Behavior, each child received ten tokens upon entering the classroom. The teachers told the children that they would receive no additional tokens. The children paid for admission to play activities as in the previous stage. (FIGURE 3) This figure shows the change in work behavior. As you can see, work behavior at first maintained itself and then decreased

sharply. The mean for the last five days was 59%. The room was very upsetting to the teachers at this point so the experimenters decided to reinstate contingent tokens after nine days.

(FIGURE 4) The graph shows the effect of reinstatement. Gradually work behavior began to rise. The mean for the last five days was 73%.

These data show that distribution of tokens contingent on work behavior, with access to readily available classroom activities as a "backup", was an effective method of increasing working behavior of Headstart children considered as a group. It is of considerable interest, however, to examine different patterns of response to the token system in individual children.

Effect of Tokens on Individual Performance

Of the fifteen children studied, six showed response patterns typical of the group data. (FIGURE 5) This figure shows the data for one of these six children. As you can see there is more variability in these data than in the group data, but the effect is still present. Points at which the lines are not connected (also marked "A" near the bottom of the graph) indicate days when the child was absent.

(FIGURE 6) This figure is typical of a second type of response pattern. The child had a relatively low baseline, which drastically increased when tokens were given contingent upon working. However, this behavior did not decrease when the tokens were no longer given for working. We have no experimental data as to why the behavior did not decrease during the reversal. Our conjecture is that the new behavior, namely working, came under the control of reinforcers other than the tokens--either the learning materials themselves or the teacher's praise. Two of the fifteen children showed this response pattern.

Three children didn't seem to come under the control of the tokens at all.

(FIGURE 7) This figure shows data on one of these children. As you can see there were quite a few absences, which was also true of the other two children showing this response pattern. For example, during the second phase, Tokens Contingent upon Working, there are only ten data points on the graph, and six absences. For the class as a whole, it wasn't until about the ninth day that work rate began to really rise and stay high. Perhaps this tells us that it took about nine consistent days for the tokens to take effect. This child had only ten days before conditions were switched. However, it should be pointed out that three other children had a slightly higher rate of absenteeism, but still came under control of the tokens to some degree. Thus absences alone do not explain the token failure here. An alternate explanation, not directly tested in this study, is that the density of reinforcement--i. e. the frequency with which tokens were distributed--was inadequate for some children.

A final response pattern is for the child whose initial work behavior was high and remained so when tokens were introduced. (FIGURE 8) There was one such child, whose data are shown here. These data suggest that token reinforcement contingent upon working behavior was not really necessary for this child. The slight drop in his work behavior during non contingent tokens as compared with baseline suggests that he may have been adversely affected by the tokens, at least temporarily.

These various patterns of response suggest that group data indicating effectiveness of a reinforcement program may often mask important differences in individual children's behavior. Thus, decisions as to when to modify treatments, when based on group data, are likely to be inappropriate for some members of the group.

(FIGURE 9) This figure shows the percent of observations that were scored as positive comments during the four stages of the experiment. These data were taken as a control to insure that the change in working behavior was not a function of fluctuations in positive comments by the teachers but of the tokens. As you can see the amount of positive social reinforcement stays relatively the same throughout the study.

Removal of Tokens

Having demonstrated the effect of tokens, the experimenters and teachers next attempted certain other manipulations in classroom procedures leading toward the eventual elimination of tokens. The first step was to introduce a "prescription system," in which children were assigned specific work materials rather than being free to choose any materials they wanted. Under the prescription system each child was given a small piece of paper with colored coded numbers on it each day. Each number referred the child to a specific set of materials. Children could work on their assigned tasks in any order and were still free to choose unassigned work material. However, tokens were given only for work on assigned tasks. In addition, check marks were placed next to each prescription number when a child finished that task. In summary, tokens were given for two different behaviors: 1) working on assigned tasks; and 2) completion of assigned tasks. Check marks accompanied the tokens distributed for task completion.

(FIGURE 10) This figure shows a very slight effect of the prescription system (marked "tasks assigned" on figure), as compared with the previous experimental period.

The prescription system was introduced primarily to capitalize on the information from a diagnostic testing program. However, it also served to establish conditions favorable to the removal of the formal token system. (FIGURE 11) This was accomplished in the following steps: 1) At point A the teachers stopped giving tokens contingent upon

working and began giving them only as tasks were completed, along with the check mark on the prescription sheet. Only one token was given for each task, and prices for admission to play activities were accordingly reduced. 2) Beginning at point B on the graph, tokens were no longer given out during the work period. Check marks continued to be given. At the end of the work period check marks were exchanged for tokens which were in turn exchanged for activities. 3) Beginning at point C tokens were removed entirely. Check marks continued to be given contingent upon task completion and were directly exchanged for activities. As you can see, there was no decrease in work behavior. In fact, there was a slight increase for the group. All children responded in essentially the same way to the task completion contingency: i. e., their work rate was high.

There are at least three possible explanations for the maintenance of work behavior during the removal of tokens. Sometime after introduction of the prescription system, the teachers, without consulting the experimenters, began to occasionally allow the children to exchange leftover tokens for small, inexpensive toys. No record was kept of when this additional exchange was permitted. However, the additional value of the tokens may have accounted for the increased working behavior while the tokens were gradually being removed. A second possible explanation is that the physical tokens actually served as distractors. Children counted them, played with them, etc. After phase A, the children no longer possessed tokens during the work period, and were less distracted from scorable "work" behavior. A third possible explanation is that the gradually increasing ratio of work output to tokens was the crucial factor in the increase in the children's work behavior. In laboratory studies it has been observed that gradually increasing the reinforcement ratio--i. e. increasing the number of responses necessary to earn a reinforcer-- has increased animals' response rates. In our study, prior to point A the children received

tokens both for working and for completing tasks. After point A the children had to complete a task before receiving any tokens. Thus teachers had in effect increased the ratio of work output to reinforcement, and an increase in the amount of work might be expected to occur. Further experimental analysis is required to test the validity of these proposed explanations.

Discussion

Perhaps the most important finding of this study is the variability of individual children's response to the same classroom reinforcement system. The implications of this finding for the application of token reinforcement programs in classrooms are profound. If results like these are replicated, it will become increasingly clear that no single reinforcement program, uniformly applied, will meet the needs of all children. Techniques for individualizing reinforcement programs will have to be developed. This may mean singling out a small number of children--those who have a particularly low rate of the behavior to be developed, for example--and using token-mediated contingencies only for those children. Another alternative would be to run an entire classroom on a token system, but to vary the reinforcement contingencies to suit each child's special needs. Either of these strategies would require the development of finely differentiated classroom management procedures by the teacher.

The results of the second part of this study are promising with respect to the possibility of fading out a dense token system while still maintaining work behavior. However, it should be pointed out that although physical tokens were completely removed, programmed consequences and backup reinforcers for working behavior still existed at the end of the study. The children continued to receive check marks which they in turn exchanged for activities. Thus, this study did not examine the effect of a complete

removal of a token economy. Further experimental studies are required to determine the rate and degree of fading of programmed consequences possible without loss of the desired behaviors.

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TABLE 1

Definitions of Working Behavior and Non-Working Behavior

Working

1. Child with hands on curriculum material, eyes on material.
2. Sitting at table or on floor or standing, material in hand, eyes on material.
3. Walking toward materials case and looking toward materials case with or without material in hand.
4. Taking material from case or putting material back in case.
5. Taking material from container or putting it into container with eyes on material and/or container.
6. In the process of working, i. e. , reaching for material.
7. Picking up material which has fallen.

Non-Working

1. No curriculum materials in hand, eyes not on material.
2. Playing without curriculum materials; for example playing with blocks or in the house area.
3. Material in hand but not looking at material.
4. Talking to another child or to teacher unless about work (as stated under W).
5. Standing or walking with material in hand, eyes not on material (unless comes under W; for example, walking to tutorial situation).

A complete list of definitions for working or non-working behavior can be obtained from authors upon request.

TABLE 2

Sample Comments Recorded as Positive

Good	You are taller
Right	You can count
Well	You two are working so well
Fine	Yes, but...
Nice	That looks like a big building
Working	That's better
Quiet	You really know your shapes, etc.
Repeats correct answer	Nice and quiet
That is correct	I'll give you a token for playing with me*
That is the one	Shawn, you have four tokens
Yeah	You'll get a token and a check*
You are working so fast	A token and a check
Much better	Uh huh
Look what Chung's done	What did you do
You are listening very closely	I gave you a token for playing with me
What do you have Chung	That was very nice of Chung
Let's see	We have to give you a check
Look at Janice	
John and Jack are...	*Experimenters asked the teachers not to use
That's a girl	statements like these, but occasionally they did.
Are you still working on that	
Look at the helpers	
You did a good job	
Yes, it is	

FIGURE 1

N=15

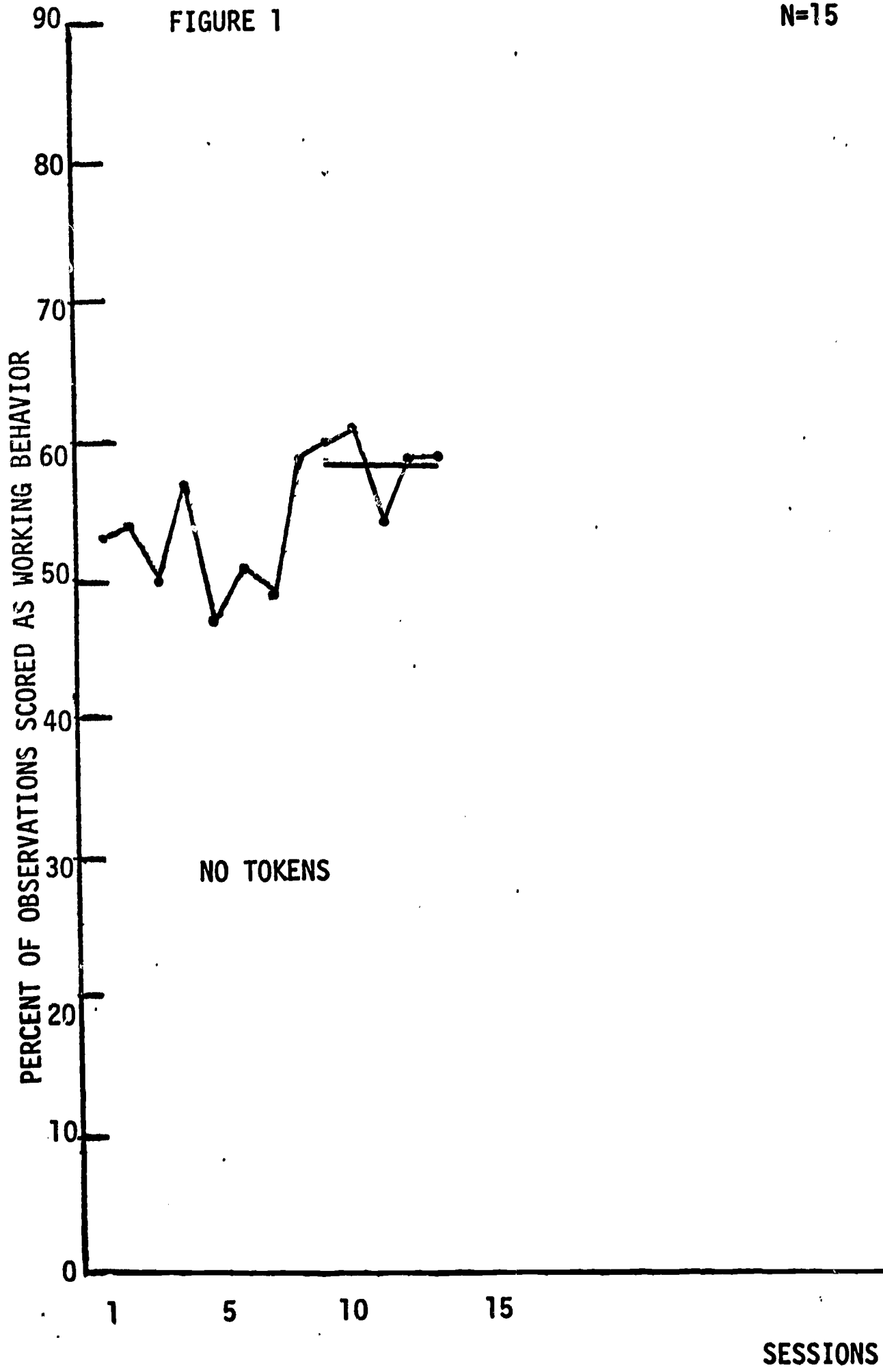
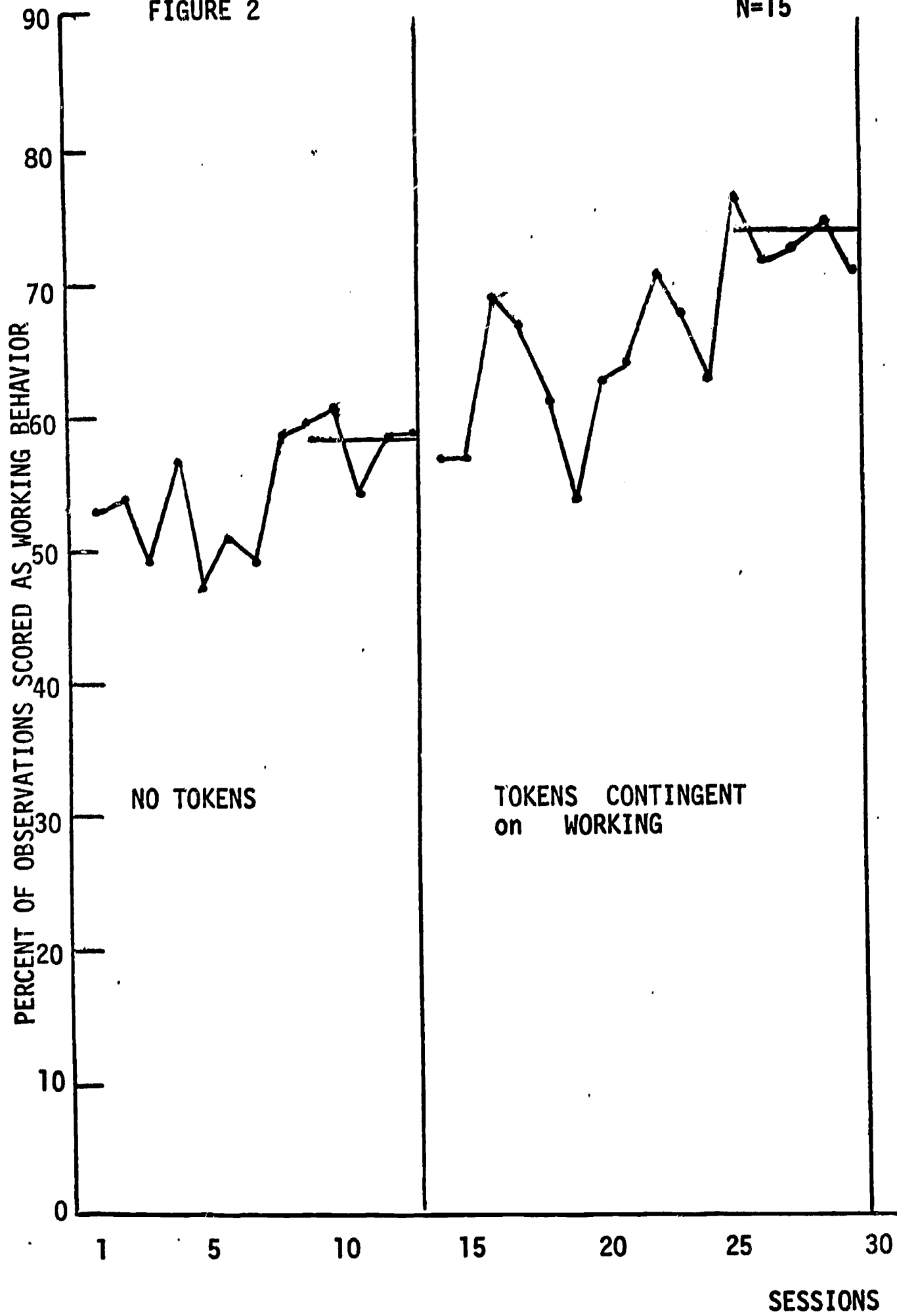


FIGURE 2

N=15



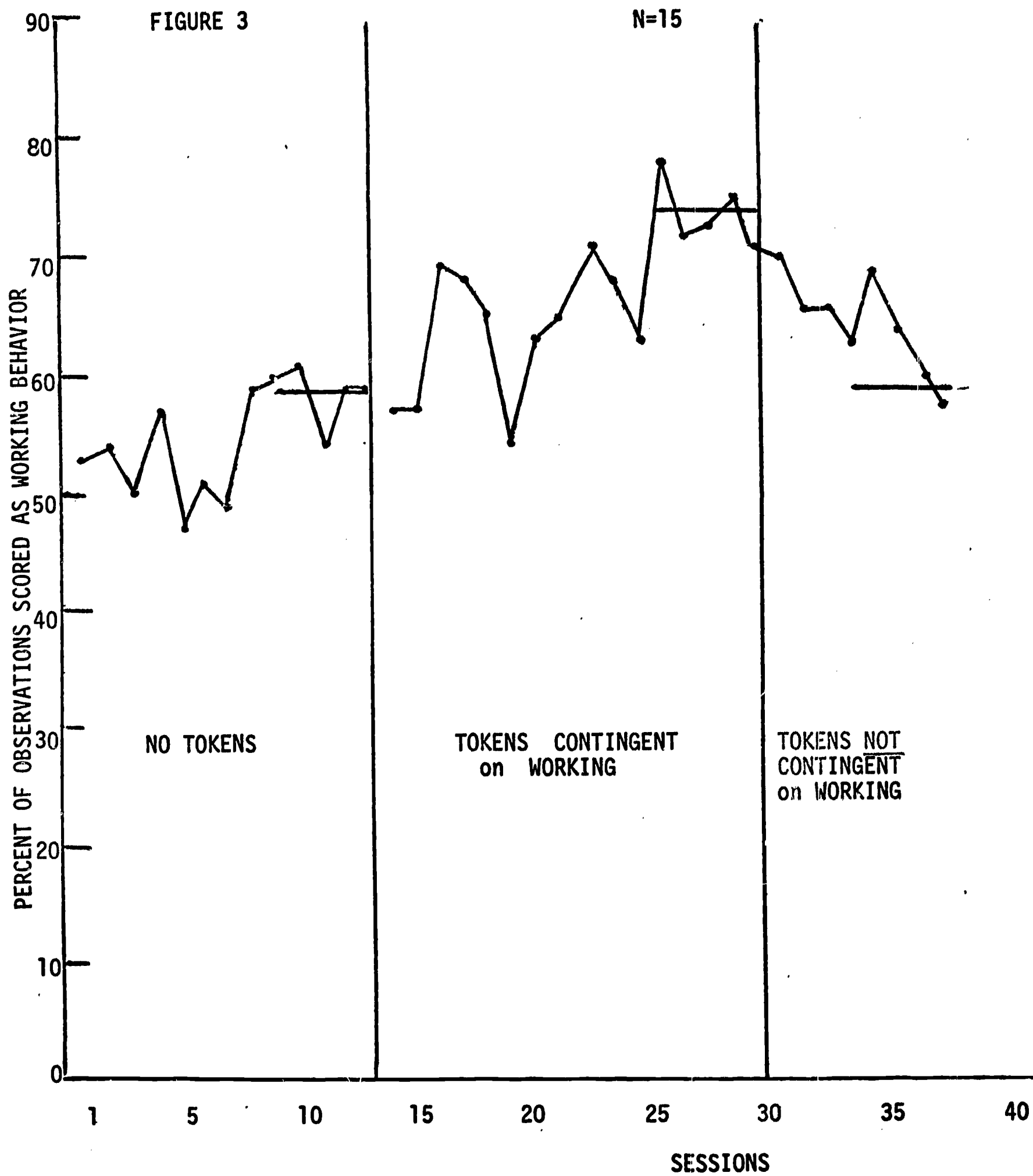


FIGURE 4

N=15

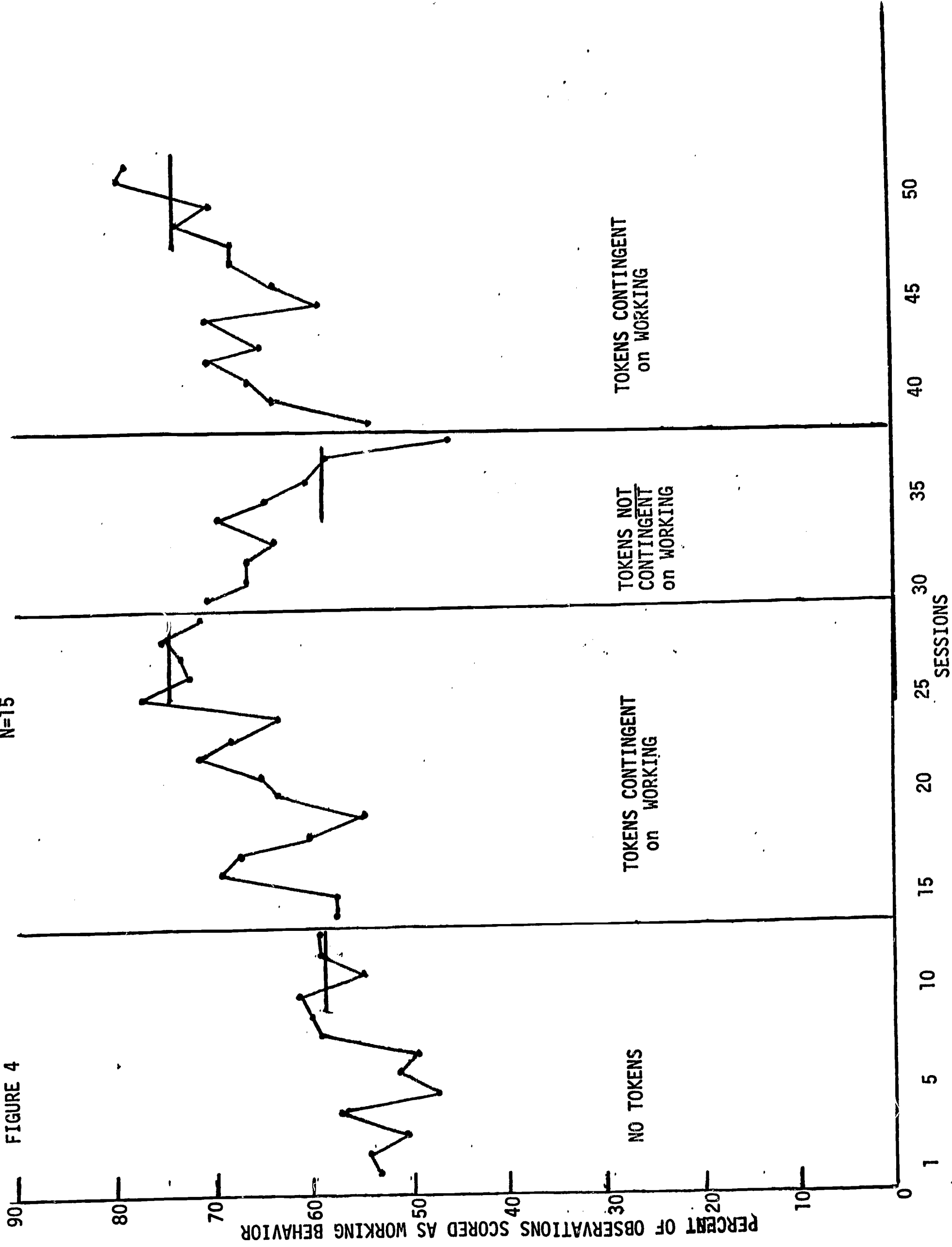


FIGURE 5

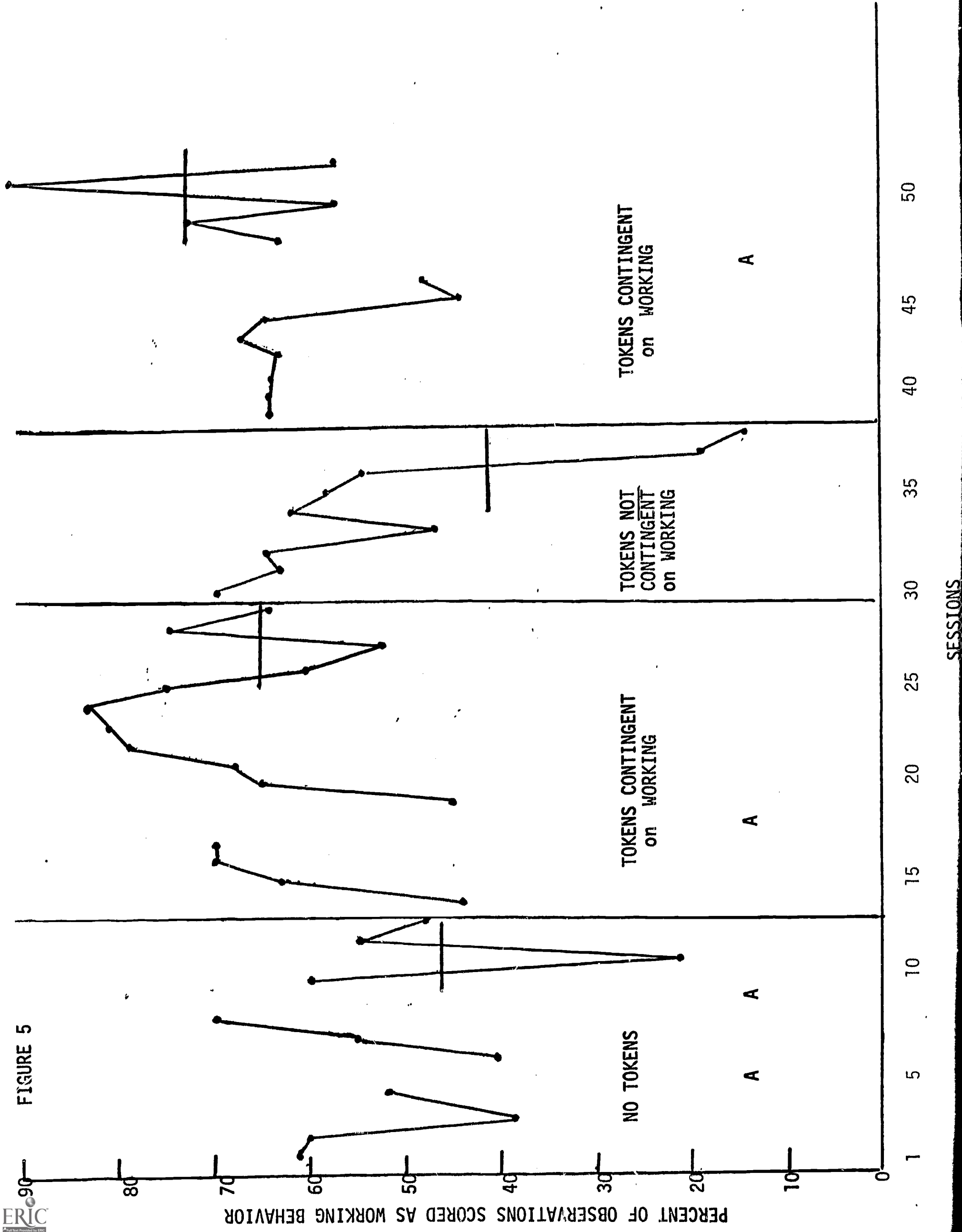


FIGURE 6

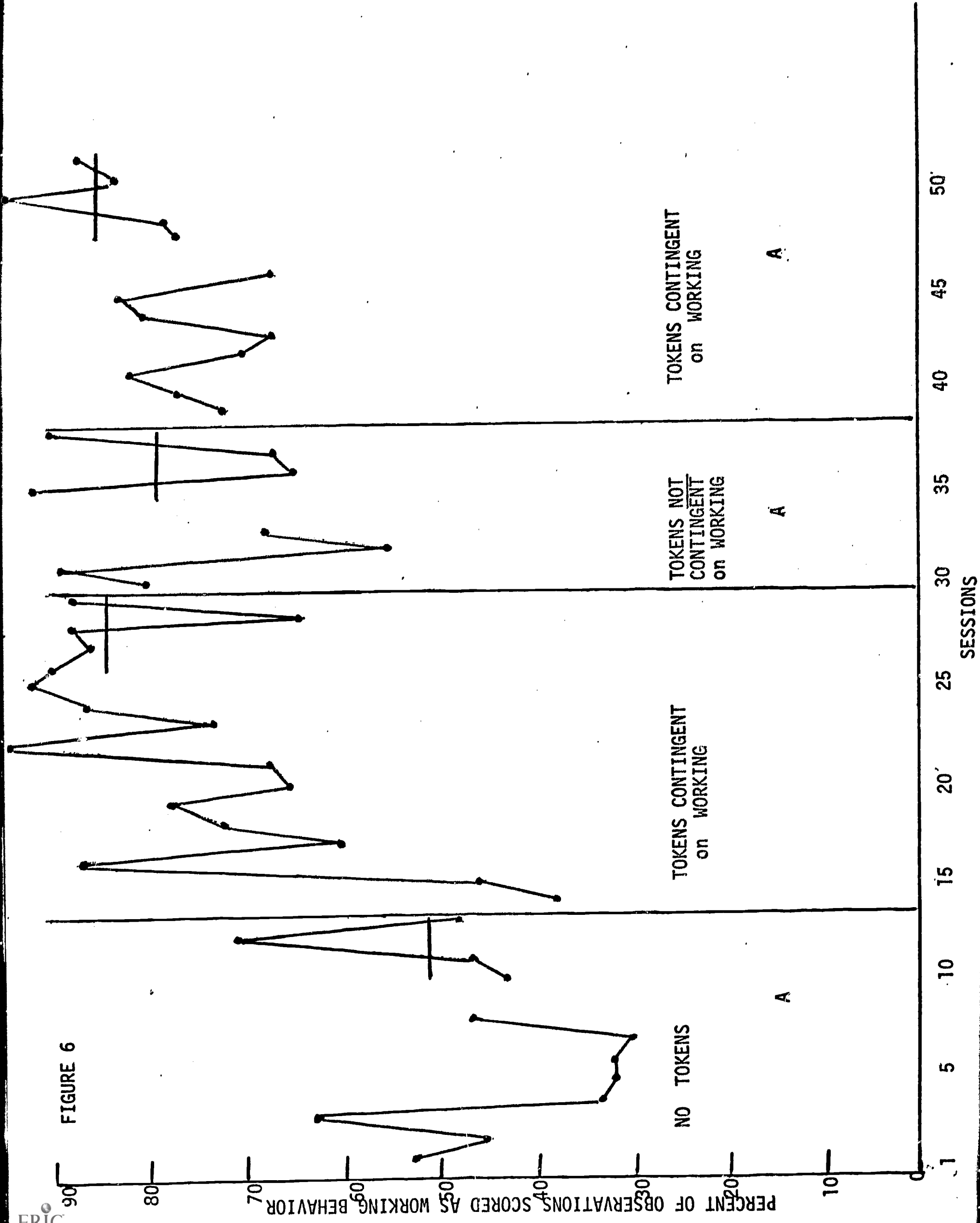


FIGURE 7

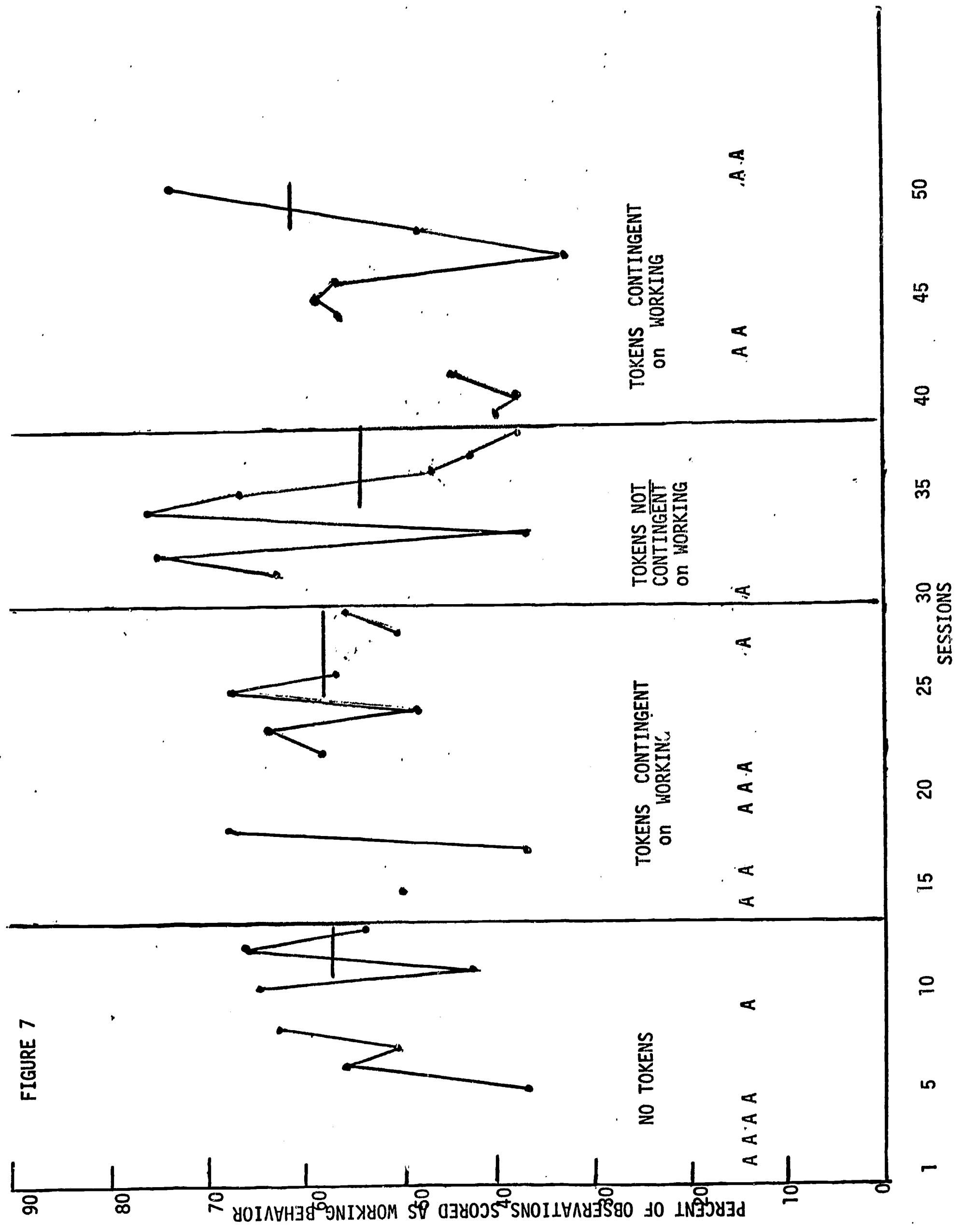


FIGURE 8

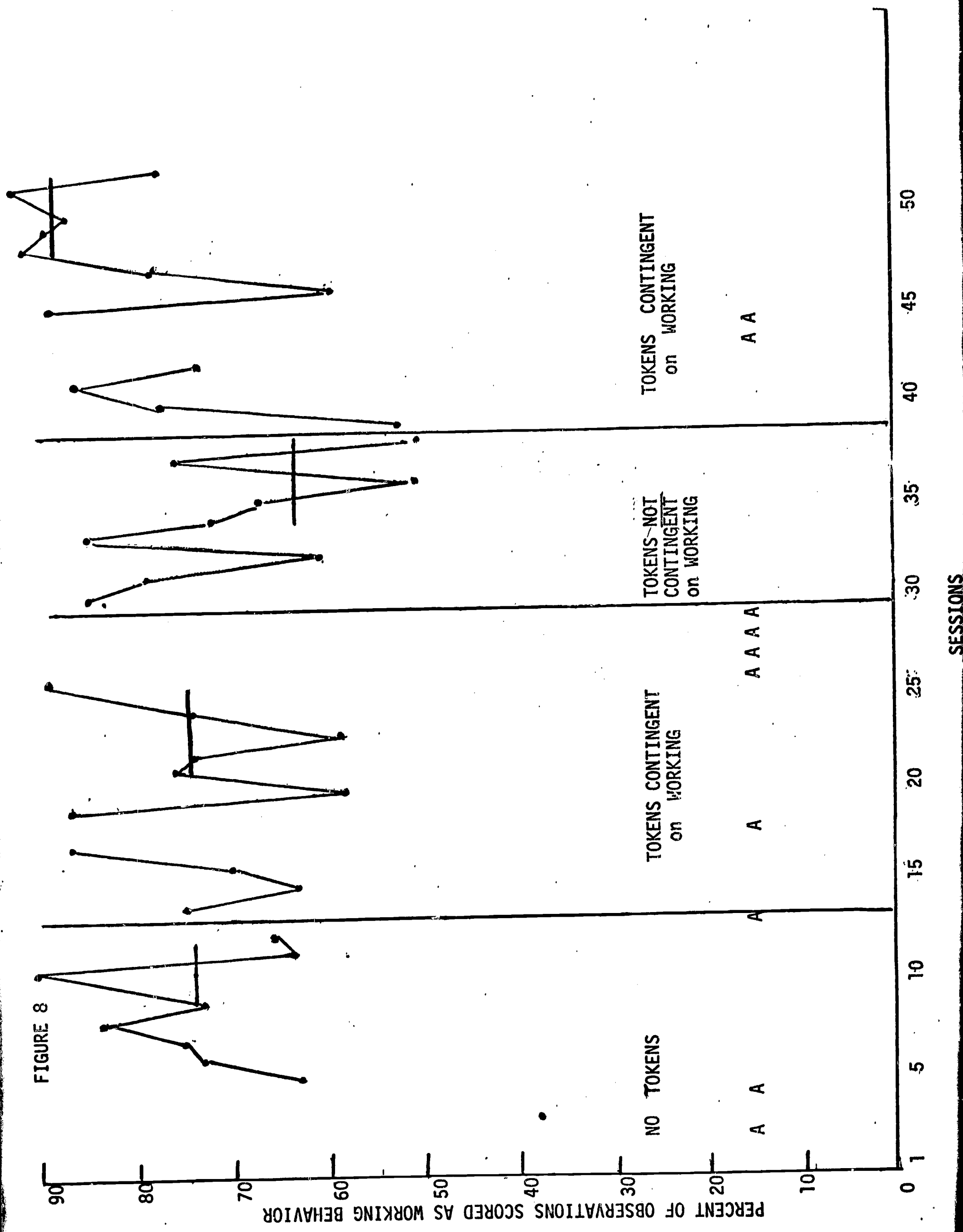
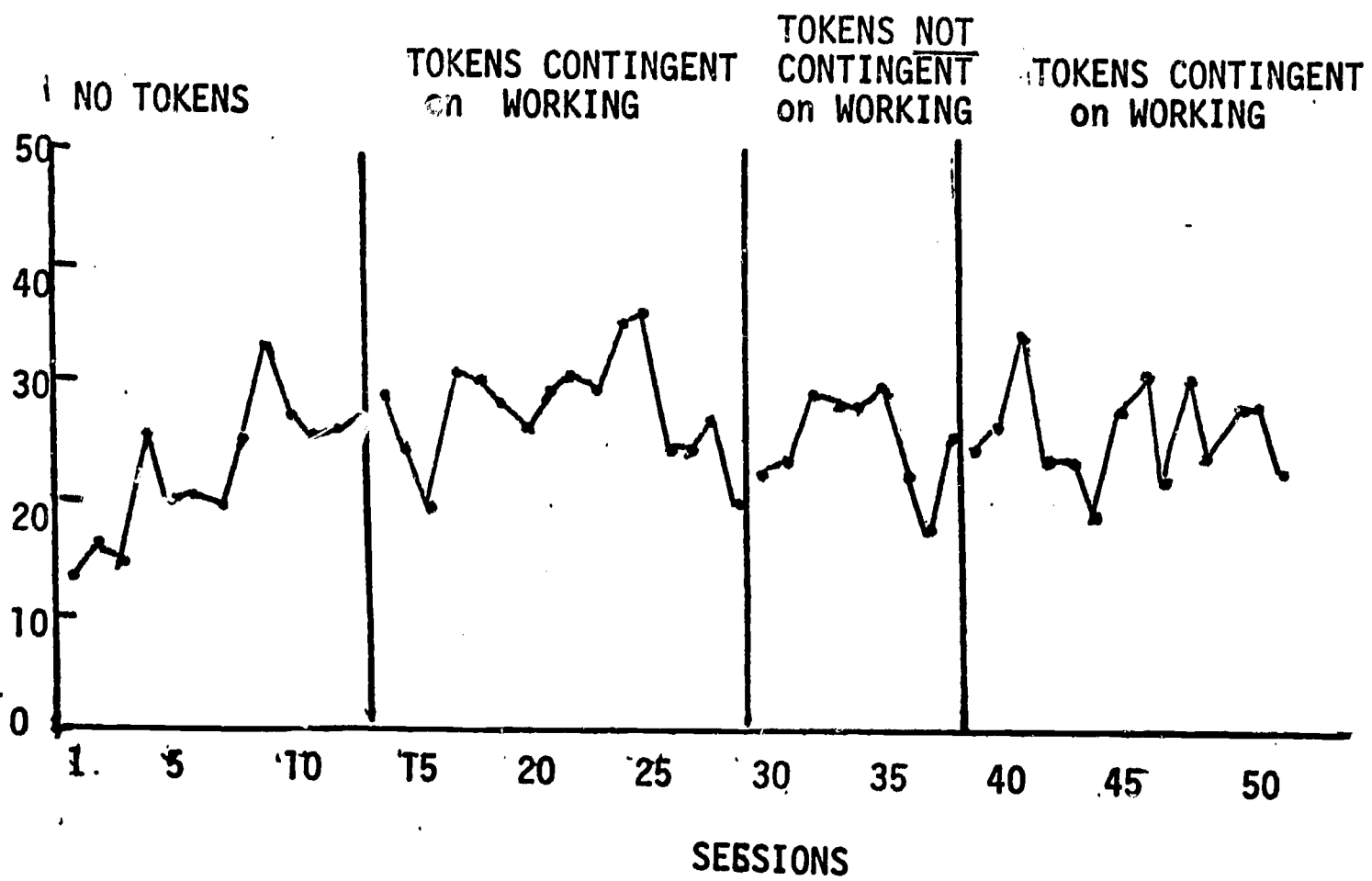


FIGURE 9



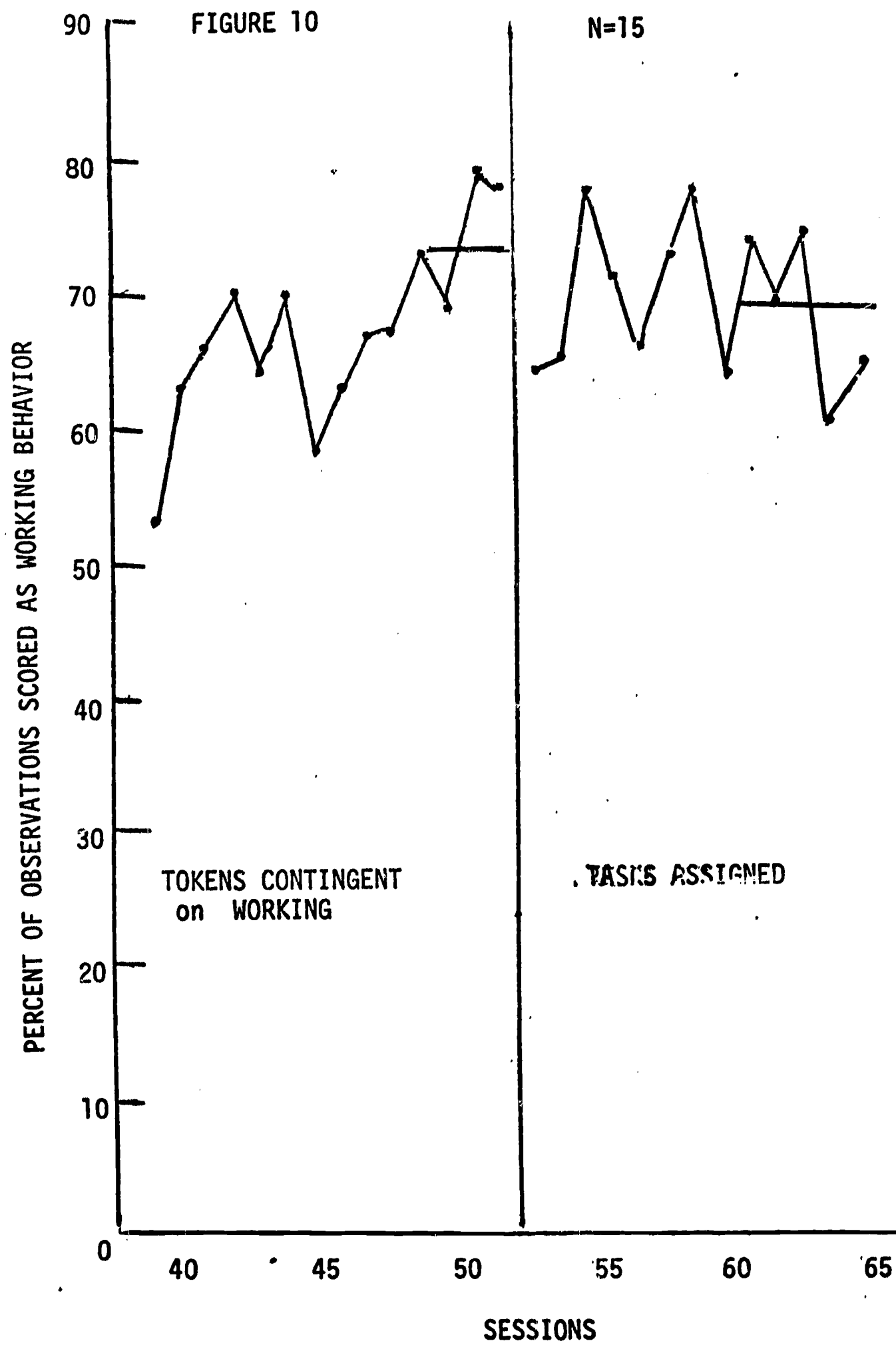


FIGURE 11

N=15

PERCENT OF OBSERVATIONS SCORED AS WORKING BEHAVIOR

TOKENS CONTINGENT
on WORKING

TASKS ASSIGNED

GRADUAL REMOVAL OF TOKENS

SESSIONS

